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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/816,820	04/05/2004	Meng-Hung Chen	CHEN3650/EM	5022
23364	7590	11/16/2005	EXAMINER	
BACON & THOMAS, PLLC 625 SLATERS LANE FOURTH FLOOR ALEXANDRIA, VA 22314			DEO, DUY VU NGUYEN	
			ART UNIT	PAPER NUMBER
			1765	

DATE MAILED: 11/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/816,820

Applicant(s)

CHEN ET AL.

Examiner

DuyVu n. Deo

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 April 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 9-19 is/are allowed.
- 6) ☒ Claim(s) 1,3,5 and 8 is/are rejected.
- 7) ☒ Claim(s) 2,4,6 and 7 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 05 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claim 1 are rejected under 35 U.S.C. 102(b) as being anticipated by Engelhardt (US 6,387,773).

Engelhardt describes a method for forming storage or trench capacitor comprising: providing a substrate 10; forming a mask pattern 11 on the substrate (col. 3, line 30-37); forming a first trench in the substrate having a first depth (col. 3, line 39-45); forming a polymer to passivate the whole trench (claimed forming a first protection layer on the surfaces of the whole structure) (col. 3, line 60-67); repeating the etching/passivating for a k times until a trench with a desire depth is formed (this would read on claimed forming a second trench, forming a second protective layer in the second trench, forming a third trench in the second trench). (col. 2, line 20-32; col. 4, line 4-21).

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 3, 5, and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engelhardt as applied to claim 1 above, and further in view of admitted prior art.

Unlike claimed invention, Engelhardt doesn't describe the depth of the first trench is greater than 100 nm, the second depth is greater than 700 nm, and the sum of the 1st, 2nd, and 3rd

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trench is greater than 7 um. Admitted prior art describes that the depth of the deep trench capacitor is typically from 7-8 um and Engelhardt is teaching a method for forming a deep trench capacitor with an etching/passivating method until a desired trench depth is formed (col. 2, line 25-33). At the time of the invention, one skilled in the art would find it obvious to determine the trench depth of each trench through routine experimentation so that an overall trench depth of 7-8 um can be formed, as taught by admitted prior art, in order to form a deep trench capacitor with a reasonable expectation of success.

Allowable Subject Matter

4. Claims 2, 4, 6, 7 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 2 is allowable because applied prior art doesn't teach or suggest the first depth is substantially equal to the junction depth of a transistor adjacent to the first trench and formed subsequently.

Claims 4 and 7 are allowable because Engelhardt doesn't suggest the first protection and second protection layer comprises a nitride layer. He teaches the protection layer is a polymer formed with CH₄, or C₂H_{2n} gases (col. 3, line 60-67).

Claim 6 is allowable because applied prior art doesn't teach or suggest the method further comprises the steps of removing a portion of the substrate on the surface of the second trench, and forming an oxide layer on the surface of the second trench, after the step of forming the second trench. Engelhardt suggests forming an oxide after the conclusion of the

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etching/passivating process for the purpose of rounding peaks in the boundary regions between the partial trench regions (col. 4, line 34-40).

Claims 9-19 are allowed because applied prior art doesn't teach or suggest the steps of:

- “forming an insulation layer on the surface of the second trench;
- forming a second protection layer on the surfaces of the whole structure,
- forming a third trench in the second trench downward, the third trench having a third depth greater than the second depth;
- forming a conductive diffusion region in the substrate of the periphery of the third trench',
- removing the first protection layer and the second protection layer;
- forming a dielectric layer on the surfaces of the overall structure;
- filling all trenches with a first conductive layer, and making the height of the first conductive layer greater than the bottom of the oxide layer of the mask layer;
- removing the oxide layer of the mask layer;
- removing a portion of the first conductive layer to make the height of the left first conductive layer greater than the bottom of the insulation layer on the surface of the second trench; and
- removing the dielectric layer not covered by the first conductive layer.”

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n. Deo whose telephone number is 571-272-1462. The examiner can normally be reached on 6:00-2:30 Mon-Fri.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Primary Examiner

Duy-Vu N. Deo

11/14/05

